

THE NATURAL HISTORY OF THE MARRON AND OTHER FRESH WATER CRAYFISHES OF SOUTH-WESTERN AUSTRALIA

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PART 2.

6.—SIZE AND GROWTH RATE OF MARRON.

There are few authentic records regarding the size attained by Marron. Ellen Clark (1936) states that the average length of adult Marron is 375 mm. (14.8 in.). This figure appears high, particularly as she examined only 12 specimens. She refers to "fully-grown" specimens equal in size to the large Murray River crayfish, *Euastacus serratus* Shaw. I find no indication that the Marron, or the Jilgie or Koonae, can ever be said to be "full-grown." Growth appears to continue throughout life.

The largest specimen in the Western Australian Museum collection, at present, has a carapace length of 162 mm. (6.4 in.), but since the specimen has been in preservative for a considerable period total length and weight cannot be determined with any reasonable degree of accuracy.

In December 1950, Master Brian Richards of Northcliffe, captured a large male Marron in the Gardner River, near Northcliffe, and forwarded it to the writer. This creature was larger than the Museum specimen, having a carapace length of 165 mm. (6.5 in.), a total length of 380 mm. (15 in.), and a weight of 3 lb. 8½ oz. It was accepted as the record until April 24, 1951, when Messrs. Jim Warr, F. G. Thorpe, J. Rickert and J. Walsh captured a large male Marron in a tributary of the same river at a point approximately 7 miles S.E. of Northcliffe. This specimen, which the writer has lodged in the W.A. Museum (No. 31-1951), weighed 4 lb. 1½ oz., with a carapace length of 171 mm. (6.75 in.), and a total length of 385 mm. (15.25 in.). The creature was caught by means of a snare at 8.30 p.m.

This record would make the Marron the third largest fresh water crayfish in the world, *Astacopsis franklinii* Gray, from Tasmania, holding pride of place as the largest, its recorded maximum weight being 8 lb. Mr. F. McNeill of the Australian Museum, Sydney, informs me that *Euastacus serratus* Shaw, can reach a length of 18 in. between the tip of the rostrum and the end of the telson. No weights are available.

Neither the Tasmanian nor the Murray River Crayfish are at all common at the sizes mentioned above, but many Marron are caught each year in the vicinity of three pounds weight.

The writer was one of a party in March 1950 which caught 47 Marron from a pool in the Warren River which measured only 150 ft. in length, 20 ft. in width, and up to 8 ft. in depth. The total weight of the catch was 60 lb. Several specimens were over 2 lb. each. This quantity was caught in 4 hours, using 11 "drop nets" of 1½-2½ in. mesh net approximately 2 ft. in diameter.

At the same time of the year, Mr. W. Loud of Pemberton, gave the writer a Marron he had caught in the Warren River (Fig. 1). Mr. Loud's Marron had a carapace length of 157 mm. (6.2 in.), total length 346 mm (13.6 in.) and a weight of 3 lb. 2 $\frac{3}{4}$ oz.

Although it would be impossible to determine the annual catch of Marron, the figure would certainly run into several thousand pounds weight. An examination of numerous catches has shown the average individual weight caught to be 8.8 oz. This would represent an average carapace length of 100 mm. (4 in.).

So far no observations of individuals of known ages have been made to establish direct evidence of the growth rate, while marking is difficult owing to the shedding of the exoskeleton periodically (ecdysis). However, experiments to provide such data are proceeding. In the meantime some indirect evidence from length frequency measurements is available.

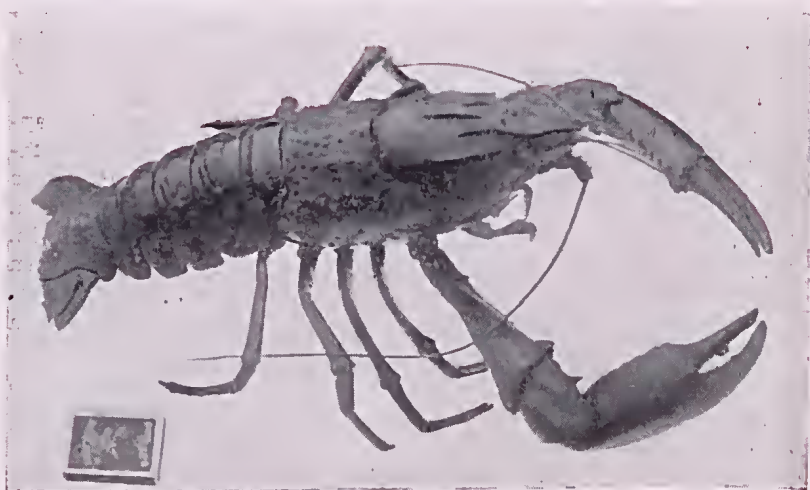


Fig. 1.—A large Marron, weight 3 lb. 2 $\frac{3}{4}$ oz.; note matchbox to indicate comparative size.

On September 26, 1950, the swimming pool at Pemberton was drained and a number of specimens were obtained for examination.

The pool is formed by an earthen wall or dam, 45 yards long with a maximum height of 15 ft., across a small stream. The water thus impounded forms an isosceles triangle 220 yards long. The bottom is covered to a depth of 1-2 feet with terrigenous and organic sediment on which grow extensive banks of *Chara* sp. A small portion of the bottom, less than 5%, has been covered with a bituminous compound, which is, of course devoid of plant life. The Trout Ponds are situated some 200 yards above the swimming pool and the waste products of the fish are carried into the pool by the stream.

Assisted by my wife and Inspector J. Simpson, of the Fisheries Department, we collected 416 Marron from the pond. As time was limited it was not possible to make the collection complete: I collected every specimen I found, but my wife and Mr. Simpson were directed to concentrate on the larger and smaller specimens. This selection somewhat militated against the suitability of the data for length-frequency analysis, introducing some anomalies in the accompanying graph and table. However some tentative inferences may be drawn.

The Marron captured ranged in carapace length (measured from the tip of the rostrum to the posterior margin of the carapace) from 15 mm. to 102 mm. The detailed measurements are given in the following table and are graphed (Fig. 2) in class intervals of 3 mm.

TABLE 1.—Carapace lengths of Marron, September 26, 1950.

m.m.	No.	m.m.	No.	m.m.	No.	m.m.	No.
15	2	37	1	59	17	81	0
16	3	38	2	60	21	82	0
17	1	39	0	61	9	83	1
18	6	40	5	62	12	84	0
19	7	41	2	63	11	85	3
20	17	42	5	64	2	86	1
21	24	43	6	65	8	87	0
22	19	44	4	66	2	88	0
23	14	45	3	67	5	89	1
24	27	46	0	68	3	90	0
25	22	47	6	69	2	91	0
26	14	48	7	70	3	92	0
27	16	49	3	71	0	93	0
28	9	50	7	72	1	94	0
29	3	51	2	73	0	95	1
30	3	52	5	74	1	96	0
31	1	53	5	75	2	97	0
32	2	54	3	76	1	98	0
33	0	55	9	77	1	99	0
34	0	56	8	78	1	100	1
35	1	57	15	79	1	101	0
36	0	58	14	80	2	102	1

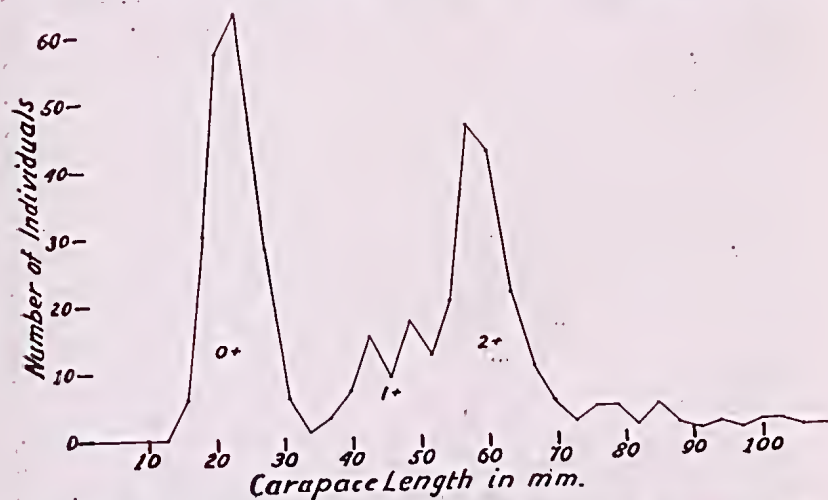


Fig 2.—Length frequencies of a Marron sample, September 26, 1950, showing presumed age groups.

It will be seen that two well-defined modes and one ill-defined, are represented in the graph, which it may be permissible to interpret as representing the mean lengths of successive year-classes. When plotted on a graph the three modes lie on a reasonable growth curve.

The smallest size-group ranges from 15-32 mm., with a mode at 23 mm., at which size the weight is approximately 1/3 oz. This group would consist of Marron of somewhat less than one year in age, as spawning takes place in spring—September to October—and hatching takes place approximately 3-4 months later. It would comprise the 0+ group on the conventional method of designating age-classes.

The next two groups, the second and third year Marron respectively, show an appreciable overlap and that the 1+ age-class (hatched in the summer of 1948-49), represented by an irregular curve, is considerably less abundant than the 2+ age-class. The form and size of the 1+ curve would be caused largely by the method of collection just stated, and also to the fact that the swimming pool had been drained each previous year. Hot dry conditions prevailing at the time of emptying would naturally affect the survival rate of the creatures inhabiting the pool. It is understood, also, that at such times children captured the majority of edible-sized Marron.

The modes of the overlapping curves are readily separated, one at about 47 mm. and the other at about 60 mm. At 47 mm. carapace length the approximate weight is $1\frac{1}{2}$ oz. and at 60 mm. $2\frac{3}{4}$ oz.

The smallest example found with ova at this time measured 48 mm. in carapace length so that sexual maturity must be presumed to begin in the region of that carapace length.

Older groups are impossible of clear identification from the length frequency curve owing to the small number of individuals.

A reasonable lower limit for Marron of a size worth while for eating would be about 75 mm. carapace length (3 in.) equivalent to a total length of 165 mm. (6.5 in.), with a weight of 5-7 oz.

From information to hand, but not yet verified, it would appear that the growth rate in newly-stocked streams and ponds is faster than that suggested by the present incomplete curve. It has been claimed that Marron 150 mm. (5.9 in.) in total length have been caught 2 years after their introduction (as ova still attached to the parent). The dams had been hitherto unstocked by crayfish.

The growth rate is relatively rapid during the juvenile stages, ecdysis occurring frequently with an expansion in carapace length of 15-17% at each moult. After one year the moults occur less frequently and probably take place only annually. If food supplies are abundant, as suggested by the size of Marron in newly-

stocked ponds, ecdysis continues to occur fairly frequently as at a carapace length of 85 mm. (3.3 in.) the expansion is only 4% after ecdysis, and the creature could not attain this size with only an annual moult.

An eye witness account of the ecdysis of a large Marron has been reported by Mr. K. Cruickshank of Pemberton.

On February 18, 1951 Mr. Cruickshank was fishing for Marron in the Warren River near Pemberton when he noticed a large specimen approximately 1 foot long lying on its side in the shallows near the edge of the stream. The creature was at first thought to be dead but on closer examination it was seen to be alive and the posterior margin of the carapace was lifting away from the abdominal shell. Mr. Cruickshank saw the creature withdraw its carapace and then its abdomen, the limbs still being contained in the old shell. After a short pause it struggled violently for a few seconds and succeeded in withdrawing its limbs, whereupon it made off rapidly into deeper water and disappeared from sight. The whole process occupied less than ten minutes.

The discarded shell was collected and brought to the writer. It was most unfortunate that the creature itself escaped, as the proportion of expansion is not known for a Marron of this size, but it was not expected that the creature would be so active after completing its ecdysis.

Much of the information still required may be obtained from the carapace only, and as it is the "tail" portion, or abdomen, that is used for consumption, "marroners" are asked to forward carapaces, raw or cooked, to the W.A. Museum for examination. The proportion of total length to carapace length has been found to be reasonably constant at 2.23 : 1, and varying from 2.16 : 1 to 2.37 : 1.

7.—REPRODUCTION OF MARRON.

The sex may be easily determined by the presence of genital papillae, fleshy protuberances, on the basal joint of each of the last pair of ambulatory limbs of the male, and the opening of the oviduct on the basal joint of the third last pair of the female.

The males' genital papillae become more erect during the breeding season, at other times being somewhat flaccid. I have been unable to verify a statement by Clark of the presence of a swelling on the outer edge of the great claws of the male as an indicator of sexual ripeness. The great claws of the male are definitely more robust, but this may be misleading as a rejuvenated limb does not regain the size of one lost. The ratio of length to width of the great claw of a mature Marron has been found to be approximately 2.5 : 1 in the male and 3.5 : 1 in the female.

Mating occurs in spring from September to October when the male deposits a mass of gelatinous spermatozoa between the last two pairs of ambulatory limbs, near the sternal keel of the female.

The spermatozoa have the appearance of boiled household starch and the mass is extremely viscid. The ova are deposited on both the front and rear side of the swimmerets. Specimens have been found with such a large number of ova that the available space on the swimmerets had been used up and ova were also attached to the posterior legs.

The Marron is a prolific egg producer compared with the Koonae or Jilgie, but the number of ova varies with the size of the parent. The youngest sexually mature individuals (members of the presumed 2+ year-class) produce 200-360 eggs; the larger individuals examined (carapace length 125-150 mm. or 4.9-5.9 in.) of unknown age but of a weight of 1½-2 lb., averaged 670 eggs. The ova are elliptical in shape and the size also varies with the age of the parent. Young individuals 60 mm. (2.4 in.) in carapace length have ova measuring 2.4 x 1.6 mm. Ova from the larger Marron, 125-150 mm. in carapace length, measure 2.8 x 2.1 mm.

Examination of catches made during the non-breeding season, namely February to August, show the sexes to be represented equally in numbers. However, during the season when they are carrying external ova or young the females represent only about 10% of the catch, and of these less than 10% actually have young or ova attached. The females apparently go into hiding during this period and this behaviour must assist materially in the preservation of the species.

Many "Marroners" are deceived regarding the spawning period by the presence of the egg of one of the Platyhelminthes, *Temnocephala*, a creature of leech-like appearance that is commensal with fresh water crayfish. The small eggs of *Temnocephala* may be found attached to the swimmerets of both male and female Marron, Jilgies and Koonaes when the crustaceans themselves are not carrying their own ova. They are easily recognised by their small size, about 0.5 mm. in diameter, and their pear-like shape.

Hatching occurs after a period of from 3-4 months, and both larvae and unhatched ova may be found in January. The newly-hatched larvae are similar in general appearance to those illustrated by Clark (1937) of the Gippsland crayfish. The swollen carapace contains a large quantity of black yolk. The larvae retain their hold by means of small hooks on the last two pairs of legs and hang head downwards, thereby differing from the crayfishes of Europe and North America.

The young remain attached to the swimmerets of their mother for a further 4 weeks, during which period they pass through a series of stages approaching and finally resembling the parent except that the great claws are very slender and rounded at their extremities. The first free-swimming young were observed on February 3, 1951 and females previously seen to be carrying ova or young were completely free of them on February 14, 1951.

When the juvenile Marron reach the stage where they take up an independent existence they have not been seen to return to their mother when disturbed.

8.—MARRON CULTURE.

Though their natural habitat is in rivers they have been known to flourish in still waters of quite limited extent. Probably the best example is provided by the experiment in stocking the disused open-cuts around the tin mining town of Greenbushes some years ago with berried females. These pits are drained occasionally and large numbers of Marron are caught.

In the Wheat-belt, near Katanning, Mr. J. F. Haddleton introduced Marron and Koonae to his dams, where they have thrived and multiplied.

It will be seen, therefore, that the habits and life history of the Marron are such that it appears eminently suitable for stocking farm ponds and dams and there are possibilities of its furnishing a valuable addition to the fare of country people in areas where fresh sea foods are unavailable.

9.—SUMMARY.

The Marron (*Cheraps tenuimanus*) occurs in all the streams between Albany and the Harvey River, and has been introduced to the Murray, Serpentine, Canning and Swan Rivers. It keeps to the larger deep basins of the rivers, usually those with a mud bottom. It is omnivorous in diet and at present would appear to be the successful competitor against any of the introduced fish. It is normally very dark red to black in colour but a deep pink and blue or an all-blue form may be occasionally found. Marron do not possess such strong burrowing tendencies as the other native species and seem more content to shelter amongst debris on the bottom of the pools. Mainly nocturnal.

Presumed growth rates under normal stream conditions are:—1st year, carapace length 23 mm., weight 1/3 oz.; 2nd year, carapace length 47 mm., weight 1½ oz.; 3rd year, carapace length 60 mm., weight 2¾ oz. Matures the third year of life (2+ year class), bearing 200-360 ova and 670 ova when the carapace length is 125-150 mm. and weight 1-2 lb. The largest specimen examined, a male, had a carapace length of 171 mm., total length 385 mm. and weight 4 lb., 14 oz.

Sexes may be distinguished by the presence of genital papillae on the last pair of ambulatory limbs of the male, and by the opening of the oviducts on the third last pair of legs of the female. The great chelae are more robust on the male. Ova are deposited on the swimmerets of the female in early spring. The male deposits masses of gelatinous spermatozoa near the female's sternal keel. The development of the egg before hatching takes 3-4 months. Young remain attached to their mother's swimmerets for a fur-

ther month before taking up an independent existence in mid-summer.

The Koonae (*C. preissii*) is found in association with the Marron but also occurs as a semi-land-inhabiting form, blue in colour, which lives in swamps, burrowing to the water table. It occurs from Perth southwards to Albany and inland to the Great Southern districts eastwards to Ongerup, but it is unknown how far introductions have contributed to this range.

The Jilgie (*C. quinquecarinatus*) is recorded from Yallingup and all the coastal streams and fresh water lakes north to the Moore River.

All species are host to a commensal Temnocephalid, which deposits its ova on the swimmerets during that portion of the year when the crayfish are not carrying their own eggs and larvae.

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NATURAL HISTORY NOTES FROM THE SOUTH COAST

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The following observations refer to three localities, all being beaches east of Esperance. These are Israelite Bay, Point Malcolm and Duke of Orleans Bay.

They were visited during the Australian Geographical Society's expedition to the Recherche Archipelago, and though only a short stay was made at each place, it has been thought worthwhile to place the information on record in view of the fact that the localities are so seldom visited. Our party included Messrs. J. Bechervaise (leader), J. Willis (botanist) and D. McKenzie (skipper of the schooner *Water Lily*). The time of the visits was from November 27 to 29, 1950.